REMARKS

Claims 1, 3-7, 9-36 and new claim 37 are pending, with claim 1 being independent. New claim 37 has been added. Support for the new claim can be found throughout the specification, including for example, at page 8, lines 7-15 and in the Examples. The Listing of the Claims is provided for the Examiner's reference.

Prior to examination, an interview is requested by Applicants. A formal interview request by the Applicants' undersigned is submitted herewith.

Applicants respectfully request the Examiner to withdraw the outstanding rejections in view of the foregoing amendments and the following remarks.

Claim Rejections under 35 U.S.C. § 103(a)

Claims 1, 3-7, 9-13, 18, 20-23, 26-28, 31, and 35-36 are rejected under 35 U.S.C. §103(a) as being unpatentable over Callahan et al. (US 2002/0010261) in view of Cantiani et al. (WO 0015667, citations in English from US 6,703,497) and further in view of Armand et al. (US 2002/0013381). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

The presently claimed ionic conduction material comprises a polymer matrix, at least one ionic species, and at least one reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils, wherein a reinforcing agent network is formed in the ionic conduction material from the reinforcing agent being brought into contact with the polymer of the polymer matrix. Applicants note that the cellulosic material is comprised of cellulose single crystals or of cellulose microfibrils, which are highly crystalline and provide mechancial strength due to their physical properties.

Moreover, a reinforcing agent network is formed in the ionic conduction material from the reinforcing agent being brought into contact with the polymer of the polymer matrix. The intimate mixture of the reinforcing agent and the polymer of the polymer matrix optimizes the electric conductivity of the ionic conduction material while presenting good mechanical strength properties, as demonstrated in Examples 1-4, 9-15, and 17. In contrast, as shown in Examples 5-8 and 16, a film of a reinforcing agent applied by lamination on a polymer materix requires a larger amount of reinforcing agent to obtain the mechanical strength. Furthermore, even if enough is used to confer the desired mechanical strength, the

film of reinforcing agent reduces the conductivity, which is not favorable to its use as an electrolyte of a battery, fuel cell, supercapacitor, or an electrochromic device, or component of a composite electrode.

Callahan relates to a polymer matrix material suitable for supporting a liquid solution. (Abstract) The polymer matrix material comprises a polymerization product of a first type of one or more monomers selected from the group of water-soluble, ethylenically-unsaturated acids and acid derivatives. ([0053]). The polymer matrix material also includes a second type monomer, generally as a crosslinking agent. ([0053]). Further, the polymer matrix material may include a water-soluble or water-swellable polymer, which acts as a reinforcing element. ([0053]).

Callahan discloses that the water soluble or water swellable polymer, which acts as a reinforcing element, may comprise polysulfone, poly(sodium-4-styrenesulfonate), carboxymethyl cellulose, sodium salt of poly(styrenesulfonic acid-co-maleic acid), corn starch, any other water-soluble or water-swellable polymers or combinations comprising at least one of the foregoing polymers. ([0064]). As described, these reinforcing elements are either soluble or swellable in water (acting as a gel). The reinforcing agents of Callahan do not confer any mechanical strength.

Cantiani describes cellulose microfibrils with modified surface characterized in that the hydroxyl functions present at the surface of the microfibrils are etherified with at least an organic compound comprising at least a function capable of reacting with the hydroxy functions. Cantiani further describes the use of these microfibrils as an agent for modifying viscosity, texture, and/or as a reinforcing filler. Cantiani provides a detailed description of the cellulose microfibrils with modified surface and of the method for making the microfibrils. However, Cantiani only provides a terse and generalized description of their use as viscosifying agents and reinforcing filler in thermoplastics and thermosetting materials. The one described and expemplified use is in a vulcanized elastomer, which can be used in any part of the tire. (Col. 10, lines 62-65 and Example 8).

Applicants respectfully submit that Cantiani does not disclose or suggest a reinforcing agent comprised of cellulose microfibrils and this reinforcing agent forming a reinforcing agent network in an ionic conduction material from the cellulose microfibrils being brought into contact with a polymer of a polymer matrix.

Armand relates to ionic compounds comprising a highly delocalized anionic charge which are useful for producing ion conducting materials or electrolytes, as catalysts and for doping polymers. Armand discloses that the ion conducting material can be used as an electrolyte in a battery comprising a negative electrode, a positive electrode and the ion conducing material as the electrolyte (see claim 33).

The paragraph [0055] of Armand, as noted by the Examiner, only indicates that the solvent for the ion conducting material is a polar polymer which can be chosen from solvating, crosslinked or non-crosslinked polymers. The solvating polymers can be chosen among a long list of polymers such as the one indicated in paragraph [0055]: polyethers of linear, comb or block structure, forming or not a network, based on poly(ethylene oxide), or… etc.

Starting from Callahan, and in considering the differences acknowledged by the Examiner in page 3 of the Office Action, the problem to be solved is to optimize the electric conductivity of the ionic conduction material, while presenting good mechanical strength properties.

Armand is concerned with improving the anionic charge of an ionic compound, while retaining good stability (see paragraph [0004]). When Armand mentions network, it only concerns a network formed by the solvating polymer as such. In addition, the network formation is not an essential characteristic of the solvating polymer because the latter can be made from various structures (see paragraph [0055] and the description of the solvating polymer as "forming or not forming a network").

Accordingly, one of ordinary skill in the art wishing to solve the above mentioned problem would not find any solution in Armand to conceive the invention as presently set forth in claim 1.

The network formation of claim 1 concerns specifically the association of a cellulose single crystals or cellulose microfibrils after they are brought into contact with the polymer matrix, and does **not** concern a network which only forms from the solvating polymer, such as the one described by Armand.

The only solution that one of ordinary skill in the art would have found in Armand is to increase the anionic charge of the ionic compound of Callahan by replacing the salts or acids of paragraph [0064] of Callahan by the specific ionic compound of Armand.

Furthermore, the paragraph [0108] of Armand, cited by the Examiner, shows an alternative to specifically improve the mechanical properties and the conductivity of a gelled electrolyte ***without using any reinforcement agent***. Indeed, to obtain such results, Armand proposes to crosslink the polyelectrolyte referenced in paragraph [0106] ***without using any reinforcing agent***, so that one of ordinary skill in the art would have been prompted to replace the polymer matrix of paragraph [0020] of Callahan by the polyelectrolyte of paragraph [0106] of Armand. This process is more complex because UV irradiation technology is used.

Hence, Applicants respectfully assert that the Examiner's conclusion of obviousness is borne from the use of impermissible hindsight reconstruction in view the disclosure in Applicant's specification. Applicants respectfully submit that the examiner has not provided a "convincing line of reasoning" as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in view of the cited documents. *Ex parte Clapp*, 227 US PQ 972, 973 (BPAI 1985). This convincing line of reasoning must comprise explaining how the disclosure of Armand would have prompted one of ordinary skill in the art to adapt Callahan because of a particular advantage, and not whether Armand simply could have prompted the man skilled in the art to adapt it as asserted by the Examiner.

Therefore, even if combined Callahan, Cantiani, and Armand do not disclose the presently claimed ion conduction material. Even if combined, Callahan, Cantiani, and Armand do not disclose or suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Specifically with regard to claim 36, Applicants note that on page 9 of the Office Action, the Examiner does ***not*** indicate, in a detailed manner, any basis for concluding that Armand discloses or suggests that a reinforcing agent (which is ***not*** described as such in Armand as detailed above) is brought into contact with the polymer in solution or in the form of a latex in suspension, or with precursors of the polymer.

Accordingly there is no basis for asserting that claim 36 is obvious in view of the cited documents.

For at least the above noted reasons, Applicants respectfully submit that claims 1, 3-7, 9-13, 18, 20-22, 26-28, 31 and 35-36 are not obvious over Callahan in view of Cantiani and further in view of Armand, and Applicants respectfully request withdrawal of this rejection.

Claims 14-17, 19, and 32-34 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Callahan et al. in view of Cantiani et al. and Armand et al. as applied to claims 1 and 18 above and further in view of Hirakawa et al. (5,281,495). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

As described above, even if combined Callahan, Cantiani, and Armand do not disclose the presently claimed ion conduction material. Even if combined, Callahan, Cantiani, and Armand do not disclose or suggest, at least, an ionic conduction material comprising a reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Hirakawa discloses a rechargeable alkaline storage cell having a negative electrode, a positive electrode, and a separator disposed between the electrodes. Hirakawa is cited for disclosing electrodes comprising carbon as conductive material and the use of manganese as insertion material. Hirakawa does not disclose or suggest a reinforcing agent, wherein the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils.

Hirakawa as cited, and in its full disclosure, does not cure the many above-noted deficiencies in Callahan, Cantiani and Armand. Accordingly, even if combined, Callahan, Cantiani in view of Hirakawa do not disclose or suggest the presently claimed ionic conduction material. Even if combined, Callahan, Cantiani, Armand, and Hirakawa do not

disclose or suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Therefore, for at least the above noted reasons, Applicants respectfully request withdrawal of this rejection.

Claims 24 and 25 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Callahan et al. in view of Cantiani et al. and Armand et al. as applied to claim 1 above and further in view of Tossici et al. (US 6,087,043). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

As described above, even if combined Callahan, Cantiani, and Armand do not disclose the presently claimed ion conduction material. Even if combined, Callahan, Cantiani, and Armand do not disclose or suggest, at least, an ionic conduction material comprising a reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Tossici discloses a lithium-ion rechargeable battery with carbon-based anode containing a lithium intercalating compound, a non-aqueous lithium ion-conducting electrolyte, and a carbon-based anode compirisng KC_8.

Tossici does not disclose or suggest that the anode also contain a reinforcing agent as presently claimed wherein the reinforcing agent is a cellulosic material comprised of

cellulose single crystals or of cellulose microfibrils and further wherein a reinforcing network is formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Tossici as cited, and in its full disclosure, does not cure the many above-noted deficiencies in Callahan, Cantiani and Armand. Accordingly, even if combined, Callahan, Cantiani in view of Tossici do not disclose or suggest the presently claimed ionic conduction material. Even if combined, Callahan, Cantiani, Armand, and Tossici do not disclose or suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Therefore, for at least the above noted reasons, Applicants respectfully request withdrawal of this rejection.

Claim 29 is rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Callahan et al. in view of Cantiani et al. and Armand et al. as applied to claim 1 above and further in view of Skotheim (US 4,442,185). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

As described above, even if combined Callahan, Cantiani, and Armand do not disclose the presently claimed ion conduction material. Even if combined, Callahan, Cantiani, and Armand do not disclose or suggest, at least, an ionic conduction material comprising a reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils wherein a reinforcing agent network is

formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Skotheim relates to a photoelectric device. Skotheim is cited as disclosing a solar cell comprising a photoanode and a cathode separated by electrolyte. Skotheim does not disclose or suggest a reinforcing agent, wherein the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils.

Skotheim as cited, and in its full disclosure, does not cure the many above-noted deficiencies in Callahan, Cantiani and Armand. Accordingly, even if combined, Callahan, Cantiani in view of Skotheim do not disclose or suggest the presently claimed ionic conduction material. Even if combined, Callahan, Cantiani, Armand, and Skotheim do not disclose or suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Therefore, for at least the above noted reasons, Applicants respectfully request withdrawal of this rejection.

Claim 30 is rejected under 35 U.S.C. §103(a) as being unpatentable over Callahan in view of Cantiani and Armand as applied to claim 1 above and fruther in view of Niu (US 6,205,016). Applicants respectfully disagree with this rejection; therefore, this rejection is traversed.

As described above, even if combined Callahan, Cantiani, and Armand do not disclose the presently claimed ion conduction material. Even if combined, Callahan,

Cantiani, and Armand do not disclose or suggest, at least, an ionic conduction material comprising a reinforcing agent, the reinforcing agent being a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer of the polymer matrix.

Niu discloses composite electrodes for use in electrochemical capacitors. Niu is cited for disclosing a supercapacitor comprised of an electrochemical cell. Niu does not disclose or suggest a reinforcing agent, wherein the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils.

Niu as cited, and in its full disclosure, does not cure the many above-noted deficiencies in Callahan, Cantiani and Armand. Accordingly, even if combined, Callahan, Cantiani in view of Niu do not disclose or suggest the presently claimed ionic conduction material. Even if combined, Callahan, Cantiani, Armand and Niu do not disclose or suggest an ionic conduction material comprising a polymer matrix, at least one ionic species and at least one reinforcing agent, wherein:

- the polymer matrix is a solvating polymer optionally having a polar character, non-solvating polymer carrying acidic ionic groups selected from the group consisting of alkylsulfonic groups, arylsulfonic groups, perfluorosulfonic groups, and perfluoro-carboxylic groups, or a mixture of a solvating or non-solvating polymer and an aprotic polar liquid;
- the ionic species is either an ionic compound selected from salts and acids, said compound being in solution in the polymer matrix, or an anionic or cationic ionic group fixed by covalent bonding on the polymer, or a combination of the two;
- the reinforcing agent is a cellulosic material comprised of cellulose single crystals or of cellulose microfibrils;

wherein a reinforcing agent network is formed in the material from the reinforcing agent being brought into contact with the polymer.

Therefore, for at least the above noted reasons, Applicants respectfully request withdrawal of this rejection.

Conclusion

For at least the reasons noted above, the art of record does not disclose or suggest the inventive concept of the present claims.

In view of the foregoing remarks, reconsideration of the claims and allowance of the subject application is earnestly solicited. If there are any questions relating to this response or the application, Applicants would appreciate the Examiner contacting the undersigned attorney to expedite prosecution.

If necessary for a timely response, this paper should be considered as a petition for an Extension of Time and please charge any deficiency in fees or credit any overpayments to Deposit Account No. 13-2725 (Docket # 70206.0005FPWO).

Respectfully submitted,

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